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ABSTRACT

The reliability of four measures of written expression was examined (total words written, mature words, words spelled correctly, and letters in sequence). Subjects included elementary-age students in several school districts, some of whom were learning disabled. Results revealed high coefficients for test-retest reliability, parallel-form reliability, split-half reliability, and interscorer reliability. Further, the reliability coefficients for total words, words spelled correctly, and letters in sequence were consistently superior, demonstrating significant precision in measurement. Two implications are drawn from the research: (1) high reliability estimates of the measures of written expression provide a necessary basis for the determination of their validity; and (2) the research assures teachers and educational professionals using formative evaluation measures that such procedures are accurate and stable. (Author/GK)

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Research Report No. 50

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Doug Marston and Stanley Deno

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THE RELIABILITY OF SIMPLE, DIRECT MEASURES OF WRITTEN EXPRESSION

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January, 1981

Abstract

The reliability of four measures of written expression (Total Words Written, Mature Words, Words Spelled Correctly, and Letters in Correct Sequence) was examined. Subjects included elementary-age students in several school districts, some of whom were learning disabled. Results revealed high coefficients for test-retest reliability, parallel-form reliability, split-half reliability, and inter-scorer reliability.

The Reliability of Simple, Direct Measures

of Written Expression

Formative evaluation systems utilizing simple, direct measures of academic performance may be employed as an alternative to traditional methods of assessing the needs of learning disabled students (Crutcher & Hoffmeister, 1975; Lovitt, Schaff, & Sayre, 1970; Mirkin & Deno, 1979). Within the formative evaluation framework, student academic performance is monitored on a frequent basis. Analysis of these time-series data should aid in the diagnosis and prescription of effective programs for students receiving learning disability services.

However, for formative evaluation systems to be implemented in the classroom, a clear description of the academic behaviors to be measured must be established. Because such measures are to be used in making decisions that influence educational programming, they must meet the standards set for psychological and educational tests (American Psychological Association, 1974; Salvia & Ysseldyke, 1978). Most important among these standards are the technical characteristics of a measure's validity and reliability (Thorndike & Hagen, 1977).

In the formative evaluation of written expression, several behavioral measures of writing performance are suggested as valid (Deno, Marston, & Mirkin, 1980); however, the reliability of these measures has yet to be determined.

Nunnally (1978) states that "measurements are reliable to the extent that they are repeatable and that any random influence which tends to make measurements different from occasion to occasion...is a source of

measurement error" (p. 225). Thus, reliability is an index of the accuracy and stability of a measure. In the American Psychological Association's Standards for Educational and Psychological Tests (1974), four types of reliability are outlined: comparisons over time; comparability of forms; internal consistency; and administration and scoring.

Comparisons Over Time

Comparisons over time usually take the form of test-retest reliability. The emphasis in this type of reliability is on the stability of the scores derived from a particular measure. Hopefully, the score obtained today will be quite similar to the score attained a week later. This approach, however, presents a significant problem in that some students may improve during the test-retest interval, thus suppressing the reliability coefficient.

Comparability of Forms

Often referred to as parallel-form reliability (Nunnally, 1978), this type of reliability analysis avoids the problems of learning and memory effects. Thorndike and Hagen (1977) suggest that variation of student scores on a measure also may be due to a biased sampling of tasks or items chosen for that measure. If a measure is inadequately constructed or if the sampling is indeed in error, then performance on the measure may not truly reflect the student's actual skills. As a result, we may not make generalizations about student performance. For example, if the number of words written in a five-minute composition is not reliable, it quite likely does not truly index the student's skills in written expression. Thorndike and Hagen

(1977) suggest that equivalent (parallel) forms of the test be produced and correlated. This suggestion fits well into the formative evaluation scheme because such a system requires several parallel measures of written expression (see Deno et al., 1980). Parallel test reliability is then quite important to substantiating the reliability of all the behavioral measures of written expression.

Internal Consistency

Internal consistency measures the average correlation among all of the items included in a test (Nunnally, 1978). The more reliable a measure is, the higher the pattern of intercorrelations.

One approach to indexing internal consistency is the split-half reliability estimate (Salvia & Ysseldyke, 1978). In this approach the items of a test usually are randomly assigned to two equal length tests. The correlation between these two tests is an estimate of the measure's reliability. In the procedures for measuring written expression, a set of items does not exist. However, by dividing the five-minute written compositions into one-minute units, one may determine the internal consistency reliability of the formative measures by treating each one-minute writing sample as an item. Assuming the student needs the first minute to warm up, a split-half analysis would focus on minutes 2, 3, 4, and 5.

Administration and Scoring

A fourth area of concern is the reliability of administration and scoring procedures. Because the reliability of scoring is crucial to the formative evaluation of written expression, interscorer agreement is analyzed. According to the Standards (American Psychological

Association, 1974), this type of reliability must be quite high.

This paper focuses on those types of reliability that make a significant contribution to the technical adequacy of the simple, direct measures of written expression. Specifically, data will be presented with respect to comparisons over time, comparability of forms, internal consistency, and interscorer reliability for four direct measures of written expression (Total Words Written, Mature Words, Words Spelled Correctly, and Letters in Correct Sequence; cf. Deno et al., 1980).

Method

Comparisons Over Time

Subjects. Twenty-eight learning disabled students attending a summer school program in a Minneapolis elementary school served as subjects for this study. Their ages ranged from 6 years, 5 months to 12 years, 2 months, with an average age of 10 years.

Procedure. Each student was administered two identical story starters, three weeks apart. The length of time for each administration was five minutes. On each occasion, the student's scores for Total Words Written, Mature Words, Words Spelled Correctly, and Letters in Correct Sequence were tabulated. Test-retest reliability for the three-week period was then determined by computing a Pearson Product-Moment Correlation for each measure between each administration.

Comparability of Forms

Subjects. Subjects were 161 elementary students selected randomly from two urban midwestern cities.

Procedure. To determine the parallel-form reliability of Total Words Written, Words Spelled Correctly, and Letters in Correct Sequence, the written compositions of the subjects were scored on these measures. Each child completed two comparable Story Starters. For the first Story Starter, the child was asked to "Write a story about the night you were camping in the woods and you heard strange noises outside your tent." In the second story starter condition, the student was asked to "Pretend you are stranded on a tropical island. Write a story about what happens to you." In each situation, the child was given five minutes to write a story.

Pearson Product-Moment Correlations were computed between the two compositions to determine the parallel-form reliability.

Internal Consistency

Subjects. Subjects were 105 elementary students in grades 1 through 6. They were selected randomly from six schools in a large midwestern city.

Procedure. To determine the split-half reliability of the direct measures of written expression, the written compositions of subjects were examined to determine how far each student had written at the end of minutes 1, 2, 3, 4, and 5. Total Words Written, the number of Mature Words Written, total Words Spelled Correctly, and the total number of Letters in Correct Sequence were then computed for each one-minute unit. The number of words written for minutes 2 and 5 were then totaled, as were the results for minutes 3 and 4. These two sums were then correlated. Performance during minutes 2 and 4 was totaled and similarly, minutes 3 and 5. Again, these two sums were correlated.

A third approach to demonstrating the internal consistency of the five-minute writing sample for the first measures employed Cronbach's Alpha (Cronbach, 1951). With this method the students' output for each minute was compared for consistency.

Administration and Scoring

Subjects. Subjects were 20 students from an elementary school in a large city in central Pennsylvania. Students were enrolled in grades 1 through 6.

Procedure. Interscorer reliability for Total Words Written, Mature Words, Words Spelled Correctly, and Letters in Correct Sequence was determined by correlating the scored results of four judges trained at the Institute for Research on Learning Disabilities. Twenty compositions written by elementary students were scored by each judge. Each judge was "blind" to the scores of the other judges. Interscorer agreement was then calculated in pair-wise fashion, producing a range of correlations that included six coefficients for each measure of written expression.

Results and Discussion

Comparison Over Time

The test-retest coefficients for a one-day interval and a three-week interval are presented in Table 1. For the one day test-retest period the correlations ranged from .57 to .92. The range of test-retest correlations for the three-week interval was .50 to .70.

Insert Table 1 about here

It is likely that the reliabilities for the three-week interval

were attenuated because of the intervening learning experiences of the 28 students, all of whom had practiced writing daily. Another factor suppressing the correlations might be attributed to the restricted range of the sample (Nunnally, 1978); all students were learning disabled.

The test-retest coefficients suggested that the best estimates of reliability are found in the Total Words Written, Words Spelled Correctly, and the Letters in Correct Sequence measures.

Comparability of Forms

Parallel-test correlations were high. The parallel test correlation coefficient for Total Words Written was .95, for Words Spelled Correctly was .95, and for Letters in Correct Sequence was .96. These highly reliable coefficients suggest that teachers may confidently use a series of story starters in the frequent measurement of written expression.

In addition to using different Story Starters in a formative evaluation system, Deno et al. (1980) also suggest employing other procedures to help students write compositions. One of these methods is the Topic Sentence, usually a brief sentence asking the child to write a topical composition. An example is, "Write about what you will do during summer vacation." Another alternative is the use of picture stimuli. In these situations, the student is asked to write a story about a picture that is presented.

In a sense, correlations among a student's written performance on these stimulus approaches are a form of parallel-test reliability, and the Pearson Product-Moment Correlations should be high. The correlations

between these various approaches are presented in Table 2. As can be seen, the reliability coefficients for Total Words Written and Words Spelled Correctly were high, ranging from .79 to .87. The reliability of Mature Words was lower, ranging from .74 to .79.

Insert Table 2 about here

Internal Consistency

Table 3 presents the split-half reliabilities for Total Words Written, Mature Words, Words Spelled Correctly, and Letters in Correct Sequence where the scores for minutes 2 and 4 were combined and correlated with the combined total of minutes 3 and 5. Also included are the split-half reliabilities for minutes 2 and 5 combined compared to minutes 3 and 4 totaled. As may be seen, the correlations ranged from .96 to .99 for the split-half reliabilities.

Insert Table 3 about here

Cronbach (1951) created a more generalizable method for determining internal consistency. His approach, called Coefficient Alpha, is the average split-half correlation based on all possible divisions of a test into two parts. Using each one-minute unit in a five-minute written sample as an item, Coefficient Alpha was calculated for Total Words Written, Mature Words, Words Spelled Correctly, and Letters in Correct Sequence. These reliability estimates also are presented in Table 3, and ranged from .70 to .87.

In all, the internal consistency reliability of the direct measures of written expression was satisfactory.

Administration and Scoring

The range of inter-judge reliability coefficients for Total Words Written, Mature Words, Words Spelled Correctly, and Letters in Correct Sequence is presented in Table 4. Also presented is the mean reliability coefficient. All reliabilities were extremely high, with coefficients of .98 and better for Total Words Written, Words Spelled Correctly, and Letters in Correct Sequence. Inter-judge correlations for Mature Words ranged from .90 to .94.

Insert Table 4 about here

Again, these reliabilities are sufficiently high to assure confidence in the use of the various measures.

Conclusions

The reliability of four formative measures of written expression was investigated in this paper. With respect to comparisons over time, comparability of forms, internal consistency, and interscorer reliability, all measures appeared to meet the professional standards set for reliability. Further, the reliability coefficients for Total Words, Words Spelled Correctly, and Letters in Sequence were consistently superior, demonstrating significant precision in measurement.

Two implications may be drawn from the research. First, the high reliability estimates of the measures of written expression provide a necessary basis for the determination of their validity. Thorndike and Hagen (1977) noted that "the ceiling for the possible validity of a test is set by its reliability" (p. 87). The high coefficients

reported here document the opportunity for establishing substantial validity for the formative measures of written expression.

Second, the research assures teachers and other educational professionals using formative evaluation measures that these procedures are accurate and stable. Indeed, the educational professional may feel quite confident about the precision of formative evaluation measurement of written expression in the classroom.

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Table 1

Test-Retest Reliability Coefficients for Four Simple, Direct Measures of Written Expression

Interval	Mature Words	Total Words	Words Spelled Correctly	Letters in Correct Sequence
1 day	.57	.91	.81	.92
3 weeks	.50	.64	.62	.70

Table 2

Correlations Between Writing Stimulus Formats on

Direct Measures of Written Expression

Dependent Measure	Story Starter and Topic Sentence	Story Starter and Picture Stimulus	Topic Sentence and Picture Stimulus
Mature Words	.75	.79	.74
Words Spelled Correctly	.81	.87	.86
Total Words Written	.79	.86	.85

Table 3

Internal Consistency Reliabilities for Four Direct Measures of Written Expression*

	Total Words Written	Mature Words Written	Words Spelled Correctly	Letters in Correct Sequence
Minutes 2 & 5 vs. 3 & 4	.99	.98	.96	.98
Minutes 2 & 4 vs. 3 & 5	.99	.98	.97	.99
Cronbach's Alpha	.87	.74	.70	.87

*All correlations significant at the .001 level.

Table 4

Interscorer Reliability Coefficients for Four Trained Judges Scoring Direct Measures of Written Expression*

	Range of Inter-Judge Reliability Coefficients	Mean Inter-Judge Reliability
Total Words Written	.98 - .99	.98
Mature Words	.90 - .94	.92
Words Spelled Correctly	.98 - .99	.98
Letters in Correct Sequence	.98 - .99	.99

*All correlations significant at .001

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